Tailoring of nanostructure in thin films through control of self-assembled block-copolymers morphology by small molecules hosting.

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Recently block-copolymers have become an important field of interest due to their self-assembled microdomains distribution on surfaces and therefore their capability to reproduce structure patterns of materials over great areas [1].Original studies from simple forms have evolved through complementation with other lithographic techniques to achieve more complex and oriented patterns. Their promising applications cover a wide area range from electronic [2] and magnetic circuits, media recording [3,4], energy efficiency, optics or biomedical [5] among others.

Precise control of size, morphology and pattern homogeneity is a key milestone to achieve before its application, consequently in this work we have studied the role of guest molecules in block-copolymer polystyrene – poly 4 vinylpyridine (PS-P4VP) leading to a versatile method to obtain a large variety of structures by spin coating processes on Si substrates (see Figure 1).

We have obtained micelles, vertical cylinders, and complex nanorings and nanomushrooms, whose sizes and interdistances we are able to tailor in ranges of 30-110 nm of diameter by tuning their chemical properties (with the inclusion of different host molecules in the P4VP cores) and physical properties during spin coating.

Furthermore, we have also studied the reproducibility of the configurations in a variety of substrates with different chemical nature, obtaining similar behavior in all samples. Finally, we have also analyzed the possibility to obtain magnetic nanoparticles by incorporation of magnetic salts with affinity for P4VP domains.

References

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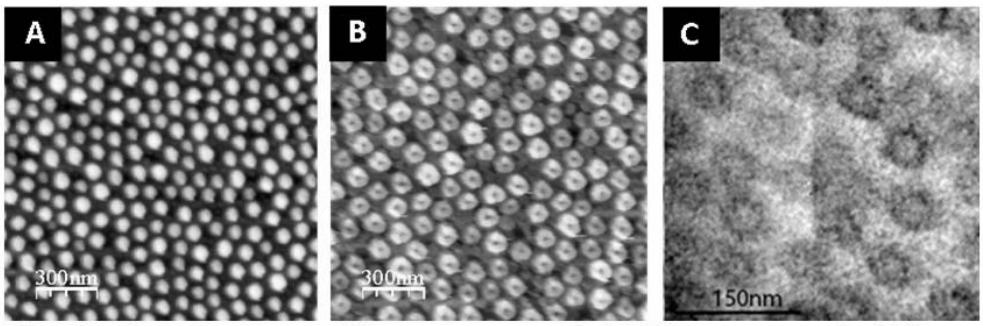

Fig 1. Atomic Force Microscope and TEM images of different structures obtained by PS-P4VP tuning (micelles and nanorings)